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APPLICATION FOR LETTERS PATENT

**Enhanced Functionality for Audio/Video Content
Playback**

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TECHNICAL FIELD

This invention relates to content playback, and particularly to enhanced functionality for audio/video content playback.

BACKGROUND

Content recording and playback devices that allow users to record and/or playback movies, television programs, and other content are commonly available. Such devices allow for the recording and/or playback of content that is recorded by the users themselves or alternatively acquired from some other source (e.g., borrowed, purchased or rented). Such devices may be analog devices (e.g., a video cassette player or video cassette recorder (VCR)) or digital devices (e.g., a Digital Versatile Disc (DVD) player or recorder).

The higher video and audio quality supported by DVD over many analog formats, as well as the ease and speed with which different portions of a DVD can be accessed, has made DVDs very popular. However, the functionality offered by DVDs is still fairly limited. For example, a user is typically limited to being able to play/pause playback of the audio/video (AV) content on the DVD, fast forward through the AV content, rewind through the AV content, or jump to a particular point in the AV content. In order to improve the user's experience when playing back content from DVDs, as well as other sources, it would be beneficial to expand the functionality provided to the user in playing back such content.

SUMMARY

Enhanced functionality for audio/video content playback is described herein.

1 In accordance with one aspect, audio/video content is received for
2 playback. Programmatic data associated with the audio/video content is also
3 received. A set of instructions is executed to enhance the playback of the
4 audio/video content, wherein the enhancement is based at least in part on the
5 programmatic data.

6 7 **BRIEF DESCRIPTION OF THE DRAWINGS**

8 The same numbers are used throughout the document to reference like
9 components and/or features.

10 Fig. 1 is a block diagram illustrating an example environment in which the
11 enhanced functionality as described herein can be made available.

12 Fig. 2 is a flowchart illustrating an example of a process for enhancing the
13 functionality of audio/video content playback.

14 Fig. 3 illustrates an example of implementing enhanced functionality for
15 AV content playback where the programmatic data and AV content are part of the
16 same data stream.

17 Fig. 4 illustrates an example of implementing enhanced functionality for
18 AV content playback where the programmatic data and AV content are different
19 data streams.

20 Fig. 5 illustrates another example of implementing enhanced functionality
21 for AV content playback where the programmatic data and the AV content are
22 different data streams.

23 Fig. 6 illustrates an exemplary general device.
24
25

DETAILED DESCRIPTION

As described herein, audio/video (AV) content is made available to users, such as by distribution of digital versatile discs (DVDs) that include the AV content. In addition to the AV content, a set of instructions is also made available to the playback device. The set of instructions, when executed by the playback device, causes the playback device to process programmatic data associated with the AV content. This programmatic data may be stored on the same source as the AV content, or alternatively stored elsewhere. The execution of this programmatic data allows enhanced functionality related to the AV content to be made available to the user, as discussed in more detail below.

General System

Fig. 1 is a block diagram illustrating an example environment 100 in which the enhanced functionality as described herein can be made available. In environment 100, a content player 102 receives data from one or more media sources 104(1), ..., 104(n). Media sources 104 can be the same type of source or alternatively different types of sources. Examples of media sources 104 include transmission sources (e.g., satellite or cable transmitters, radio frequency (RF) transmitters, streaming media servers accessible over the Internet, etc.) and distribution sources (e.g., optical discs such as DVDs, magnetic disks or tapes, etc.).

Content player 102 receives at least three types of data from media sources 104: AV content, programmatic data, and a set of instructions. This various data can be received from the same media source 104, or alternatively from different media sources 104. For example, the AV content and set of instructions may be

1 received from one media source 104 (e.g., a DVD), while the programmatic data is
2 received from another media source 104 (e.g., a network server). The set of
3 instructions, also referred to herein as an executable, is typically received from the
4 same media source as the AV content, although the set of instructions may
5 alternatively be received from a different media source. The set of instructions are
6 executed to process the programmatic data, as discussed in more detail below.
7 Although referred to herein as an executable or the set of instructions being
8 executed, it is to be appreciated that the instructions may be in some other form,
9 such as an interpreted program that is to be translated by an interpreter of content
10 player 102.

11 The AV content refers to the audio and visual content that is to be presented
12 to the user as the AV programming. The AV programming can be any of a variety
13 of types of AV content, such as a movie (including home-movies (e.g., made with
14 a camcorder or computer), movies made for television, movies made for theatrical
15 release, movies made for the home-entertainment market, etc.), other television
16 programs (e.g., sitcoms, news broadcasts, sporting events, documentaries, home
17 shopping channels, etc.), and so forth.

18 Typically, such as when the media source is a DVD, the AV content is
19 made up of an AV stream that includes a video track having the video data to be
20 displayed to the user, and an audio track having the audio data to be audibly
21 played to the user. A media source may have multiple audio and/or video tracks
22 for particular AV programming. For example, different audio tracks may be
23 associated with the same video track, such as audio tracks being in different
24 languages, or a director's commentary regarding the AV programming. By way of
25 another example, different quality video tracks (e.g., obtained using different

1 compression ratios) may be associated with the same audio track. Typically, the
2 AV stream received by content player 102 includes a single audio track and a
3 single video track, although alternatively a stream may include multiple audio
4 tracks and/or multiple video tracks.

5 During operation, content player 102 includes an AV playback module 106
6 and a programmatic data control module 108. AV playback module 106 processes
7 and outputs the AV content for presentation to the user. AV playback module 106
8 receives the AV stream from media source 104 (and/or module 108, as discussed
9 in more detail below) and converts the data in the received audio and video tracks
10 to an appropriate format for audible and visual playback to the user. Content
11 player 102 may include the hardware for presenting the AV content to the user
12 (e.g., a display device and a speaker), or alternatively content player 102 may
13 generate an AV output to one or more other devices for the one or more other
14 devices to present the AV content to the user.

15 Programmatic data control module 108 is the set of instructions that are
16 received by content player 102. The set of instructions are loaded into content
17 player 102 from a media source(s) 104. The set of instructions may be loaded into
18 content player 102 at any time so long as they are available when the
19 programmatic data is to be processed. Typically, the set of instructions are loaded
20 when the media source 104 is first accessible to content player 102 (e.g., when the
21 DVD is first loaded into content player 102, or a streaming media server is first
22 accessed by content player 102). Programmatic data control module 108
23 processes the programmatic data received by content player 102, and operates to
24 carry out the functionality described by the programmatic data. Depending on the
25 particular enhanced functionality provided by the programmatic data, this

1 processing of the programmatic data may optionally involve operating on the AV
2 content as well, as discussed in more detail below.

3 The set of instructions for all of the enhanced functionality associated with
4 particular AV content are typically loaded into content player 102 together.
5 Alternatively, different sets of instructions may be used for different enhanced
6 functionality associated with the AV content, and the individual sets may be
7 loaded into content player 102 only when that enhanced functionality is invoked
8 by the user.

9 Furthermore, it should be noted that, based on the capabilities of content
10 player 102, the set of instructions for multiple different AV content may be
11 maintained by player 102 concurrently. For example, the AV content may be
12 uniquely identified (e.g., based on a unique id assigned to AV content received
13 from a media server, or based on the data stored on the DVD on which the AV
14 content is stored) and this identifier may be associated with the set of instructions
15 saved to a nonvolatile storage device (e.g., a hard disk) of content player 102. By
16 so saving the set of instructions, the set of instructions need not be re-loaded on
17 content player 102 when the AV content is subsequently accessed by content
18 player 102 (e.g., when the user next desires to playback the AV content).

19 Fig. 2 is a flowchart illustrating an example of a process 140 for enhancing
20 the functionality of audio/video content playback. The process of Fig. 2 is
21 implemented by content player 102 of Fig. 1, and may be performed in hardware,
22 software, firmware, or combinations thereof.

23 Initially, an AV content stream and programmatic data are accessed (act
24 142). As discussed above, the AV content stream and programmatic data may be
25 accessed from the same media source or alternatively different media sources. A

1 user input requesting an action(s) is also received (act 144). Any of a variety of
2 actions may be requested by the user. These actions may be traditional actions for
3 navigating playback of the AV content (e.g., stop, pause/play, fast forward,
4 rewind, etc.), or may be other actions specifically requesting particular enhanced
5 functionality (e.g., requesting intelligent scanning, requesting automatic recap or
6 summary, etc.). Examples of this enhanced functionality are discussed in
7 additional detail below.

8 The user can input such requests in any of a variety of manners. For
9 example, the user may have access to a remote control device that communicates
10 (e.g., via infrared (IR) or radio frequency (RF)) with content player 102. This
11 remote control device can have various buttons (e.g., having functionality defined
12 by the manufacturer or reseller of the remote control device, or by the user) that
13 can be selected by the user to cause the particular request to be input. By way of
14 another example, the user may have a handheld game controller (e.g., for use with
15 a gaming device) having one or more of a joystick(s), button(s), and trigger(s). A
16 button or trigger may be defined with a particular request, or alternatively the user
17 may control an on-screen pointer with the handheld game controller (and thus
18 navigate the pointer to a particular selection, such as an on-screen button or menu,
19 and select the desired request by activating a button or trigger on the controller).

20 When the user input is received, the programmatic data and optionally the
21 AV stream are used to perform the requested action (act 146). The exact
22 operations that are carried out to perform the requested action can vary based on
23 the enhanced functionality being invoked. Specific examples of such enhanced
24 functionality are described in additional detail below.

1 It should be noted that the order in which acts 142, 144, and 146 are
2 illustrated in Fig. 2 does not imply any particular required order in which the acts
3 are to be carried out. Multiple acts may be carried out concurrently (e.g., acts 142
4 and 144 may be performed at the same time), or the acts may be performed in an
5 order different than the illustrated order (e.g., act 144 may occur prior to at 142).

6 The enhanced functionality for AV content playback described herein is
7 made possible by use of the set of instructions and programmatic data associated
8 with the AV content. However, the structure of the AV content itself need not be
9 altered from current standards. For example, the AV content on a DVD that
10 supports the enhanced functionality described herein would be the same audio and
11 video tracks as on a DVD that does not support the enhanced functionality
12 described herein. Thus, if a DVD that supports the enhanced functionality
13 described herein is played back on a DVD player that does not understand the
14 programmatic data or the set of instructions (such DVD players are also referred to
15 as legacy devices), the DVD player can still access and playback the AV content
16 from the DVD. However, if a DVD that supports the enhanced functionality
17 described herein is played back on a DVD player that does understand the
18 programmatic data and the set of instructions, then the enhanced functionality
19 described herein is made available to the user of that DVD player.

20 21 **Example Implementations**

22 The enhanced functionality described herein can be implemented in a
23 variety of different manners. Figs. 3, 4, and 5 illustrate three example
24 implementations, although different implementations may alternatively be
25 employed.

1 Fig. 3 illustrates an example of implementing enhanced functionality for
2 AV content playback where the programmatic data and AV content are part of the
3 same data stream. The AV content and programmatic data stream 202 is received
4 from the same source (e.g. from a single DVD) and, as illustrated, are part of the
5 same stream. For example, the AV content and programmatic data may be
6 received as a single stream that includes an audio track(s), a video track(s) and a
7 programmatic data track(s). During playback of the audio and video tracks,
8 programmatic data control module 204 extracts the programmatic data for
9 processing. It should be noted, however, that the programmatic data is not
10 processed until a user input requesting an action is received (although such a
11 request may be a request to play the AV content).

12 Fig. 4 illustrates an example of implementing enhanced functionality for
13 AV content playback where the programmatic data and AV content are different
14 data streams. The AV content stream 222 includes an audio track(s) and a video
15 track(s), while the programmatic data stream 226 is a separate stream. The
16 programmatic data stream 226 is obtained locally as is AV content stream 222,
17 and the streams 226 and 222 may be obtained from the same media source (e.g.,
18 the same DVD) or alternatively different media sources (e.g., AV content stream
19 222 may be obtained from a DVD while programmatic data stream 226 is obtained
20 from a local hard drive).

21 During playback of the AV content, programmatic data control module 224
22 monitors the AV content stream 222 and uses location identifiers from AV content
23 stream 222 to index into local programmatic data stream 226. In one
24 implementation, these location identifiers are temporal location identifiers. AV
25 content stream 222 is time indexed in some manner (e.g., in accordance with any

1 of the DVD standards), and this indexing can be used to map or index into the
2 local programmatic data. For example, local programmatic data 226 and/or
3 executable 224 can include a mapping of AV content stream 222 location
4 identifiers to programmatic data. Based on the current location of AV content
5 stream 222 being played back, the corresponding programmatic data 226 can be
6 readily identified and processed by programmatic data control module 224.

7 Fig. 5 illustrates another example of implementing enhanced functionality
8 for AV content playback where the programmatic data and the AV content are
9 different data streams. Fig. 5 is similar to Fig. 4, except that the programmatic
10 data is obtained from a remote media source. Programmatic data control module
11 244 uses a location identifier of the current location of AV content stream 242
12 being played back to map into the programmatic data, similar to programmatic
13 data control module 224 of Fig. 4. However, to access the programmatic data,
14 programmatic data control module 244 accesses a programmatic data database 248
15 by way of a server 246. The programmatic data may be accessed on-the-fly (e.g.,
16 the current programmatic data is determined based on the current playback
17 location of the AV stream 242), or portions (or all) of the programmatic data
18 corresponding to AV stream 242 may be downloaded and made available locally
19 to programmatic data control module 244.

20 Regardless of the way in which the example functionality is implemented
21 (e.g., in accordance with any of the examples of Figs. 3, 4, and 5, the enhanced
22 functionality can be invoked in any of a variety of manners. The particular
23 manner in which particular enhanced functionality is invoked can vary based on
24 the type of functionality as well as the desires of the AV content developer (and/or
25 the developer of the programmatic data, and/or the developer of the programmatic

1 data control module, etc.). Different types of functionality may be invoked in
2 different manners even though associated with the same AV content.

3 Examples of the way enhanced functionality can be invoked include:
4 activation of a navigation button on a remote control device or on content player
5 102 (e.g., buttons for play, pause, stop, fast forward, rewind, etc.); activation of a
6 virtual button displayed on-screen (e.g., displayed on the same display device as
7 the AV content or alternatively on some other device), such as a navigation button
8 or some other button; activation of a specialized or dedicated button (a virtual
9 button displayed on-screen, a button on a content player 102, a button on a remote
10 control device, etc.), such as a scan button (to invoke the Intelligent Scanning
11 functionality), a virtual walkthrough button (to invoke the Virtual Walkthrough on
12 Rails functionality), a takeover button (to invoke the Takeover Action
13 functionality), etc.; activation of a button, trigger, joystick, etc. on a game
14 controller (e.g., moving the joystick to invoke the Freeform exploration of the
15 World functionality, pressing a trigger or button to invoke the Episodic Download
16 of Additional Content functionality, etc.); and so forth.

17 Similarly, once the enhanced functionality is invoked, the enhanced
18 functionality may be controlled in any of a variety of manners. The particular
19 manner in which particular enhanced functionality is controlled can vary based on
20 the type of functionality as well as the desires of the AV content developer (and/or
21 the developer of the programmatic data, and/or the developer of the programmatic
22 data control module, etc.). Different types of functionality may be controlled in
23 different manners even though associated with the same AV content.

24 Examples of the way enhanced functionality can be controlled include:
25 automatic control (e.g., once invoked nothing more needs to be done by the user),

1 such as for the Different Aspect Ratios functionality or the HDTV Version Video
2 functionality; selection of a virtual button, menu item, link, or other item
3 displayed on-screen (e.g., displayed on the same display device as the AV content
4 or alternatively on some other device), such as a navigation button or some other
5 button; selection of a specialized or dedicated button (a virtual button displayed
6 on-screen, a button on a content player 102, a button on a remote control device,
7 etc.), etc.; activation of a button, trigger, joystick, etc. on a game controller (e.g.,
8 moving the joystick to move around using the Freeform exploration of the World
9 functionality, etc.); and so forth.

10 Additionally, depending on the device(s) available to the user, the
11 programmatic data may be accessed in different ways, such as allowing particular
12 enhanced functionality based on the types of devices available to the user and/or
13 being used by the user. For example when the user has a DVD remote control, the
14 user can access enhanced functionality such as 360 Degree Pause, Intelligent
15 Scanning, Multiform Stories, etc., whereas if the user has a game controller, the
16 user can have access to enhanced functionality such as Takeover Action, Freeform
17 Exploration, etc., and if the user has a headset (e.g., including one or more
18 speakers and/or a microphone), the user can have access to enhanced functionality
19 such as Multiplayer Worlds, Character Innerdialog, etc.

21 **Example Functionality**

22 Any of a variety of enhanced functionality for AV content playback can be
23 made available by the set of instructions and programmatic data associated with
24 the AV content. Several examples of such enhanced functionality are included in
25 this section. However, it is to be appreciated that these are merely examples, and

1 that other types of enhanced functionality may also be made available.
2 Additionally, it should be noted that different AV content may be associated with
3 different types of enhanced functionality, and that different versions of the same
4 AV content (e.g., on different distribution media) may be associated with different
5 types of enhanced functionality. For example, a movie on one DVD may have
6 both the Infopause and Intelligent Scanning functionality, while the same movie
7 on a different DVD may have the Multiplayer Worlds and Takeover Action
8 functionality.

9 Many of the example functionalities discussed herein refer to what a
10 particular user can do. It is to be appreciated that multiple users may be using a
11 single content player 102 concurrently, and that these multiple users may invoke
12 different enhanced functionalities. For example, two users may invoke the
13 Character Innerdialog functionality for different characters, or one user may
14 invoke the Character Innerdialog functionality while the other user invokes the
15 Takeover Action functionality.

16 17 Enhancement of Content Stream Quality

18 The quality of the video in the AV output from content player 102 can be
19 enhanced by using programmatic data in the form of an additional track(s) or
20 stream(s) that, when combined with a track of the AV content, improves the
21 quality of the picture and/or the quality of the audio output by using a processor of
22 content player 102. As the AV content is received, programmatic data control
23 module 108 adds in additional detail (based on the programmatic data) to the
24 audio and/or video track of the AV content in order to improve the quality of the
25 particular track. The programmatic data includes, for example, data describing

1 the difference between the improved quality version of the video (and/or audio)
2 and the track(s) of the AV content. So, when the programmatic data is combined
3 with (e.g., added to) the AV content, the improved quality video (and/or audio) is
4 obtained.

5 6 HDTV Version Video

7 The AV content can be enhanced to create an HDTV (High Definition TV)
8 version of the AV content by using programmatic data in the form of an additional
9 track(s) or streams(s). As the AV content is received, programmatic data control
10 module 108 adds in additional detail (based on the programmatic data) to the
11 video track of the AV content. This additional detail includes the additional
12 descriptive information that is the difference between the HDTV version of the
13 video and the version included in the video track of the AV content. In other
14 words, the programmatic data includes the “delta” or difference that, when added
15 to the video track, results in the HDTV version of the video. These differences
16 could include, for example, both the “larger” screen area not shown in the NTSC
17 or PAL version of the AV content but supported by HDTV and the increase in
18 quality that state of the art compression provides over older “standards” (e.g., over
19 MPEG-2).

20 21 Different Aspect Ratios

22 The AV content can be altered to be any of multiple different aspect ratios
23 (for example, 4:3, 1.85:1, 2.35:1, and so forth). Programmatic data control
24 module 108 re-formats the AV stream to the desired aspect ratio prior to content
25 player 102 outputting the AV output. By re-formatting the AV stream at content

1 player 102, different versions of the AV content (the different versions having
2 different aspect ratios) need not be maintained as separate video tracks.

3 The Different Aspect Ratios functionality allows multiple different aspect
4 ratios to be easily supported on the same media source. For example, multiple
5 different aspect ratios can be supported on the same side of a DVD (rather than
6 having one disc recorded using a first aspect ratio while the other disc is recorded
7 using another aspect ratio).

8 In one implementation, the video track of the AV content is the largest of
9 the possible dimensions supported by the Different Aspect Ratios functionality
10 (that is, the video track includes all of the data that would be needed to generate
11 any of the supported aspect ratios). Upon receiving the video track, programmatic
12 data control module 108 converts the data in the video track to the appropriate
13 dimension by removing those portions of the data that are not needed for the
14 desired aspect ratio. This removal may be a straightforward algorithm (e.g.,
15 remove the data for certain rows or columns of pixels in the images represented by
16 the data on the video track), or alternatively may incorporate additional
17 intelligence. For example, when converting to the 4:3 aspect ratio it may not
18 always be desirable to remove the same rows and/or columns of pixels in the
19 images represented by the data on the video track, but rather to remove different
20 rows and/or columns for different images. In such situations, which rows and/or
21 columns of pixels are to be removed from which images represented by the data
22 on the video track is identified in the programmatic data.

23 Using the programmatic data, many different aspect ratios can be supported
24 on the same media source (e.g., the same DVD). For example, the “normal” DVD
25 could be the 4:3 aspect ratio “Pan & Scan” which only shows a portion of the

1 movie window. If the user has an HDTV, they can specify the 16:9 “wide screen”
2 format and the additional data required for the 16:9 wide screen format will be
3 obtained from the programmatic data. In this way, users with legacy equipment
4 have a good version for them (e.g., 4:3 Pan & Scan) and users with new equipment
5 have a good version (e.g., 16:9 widescreen) for them.

7 Popup Information

8 The programmatic data can include popup images and/or text that overlay
9 the video content during playback. The popup images are incorporated into the
10 video content, and can be displayed "on top" of the video content. The popup
11 images and/or text may be always displayed or alternatively may be displayed
12 only in response to a particular action (e.g., the user activating a button on a
13 remote control, or picking up the remote control). The popup images and/or text
14 may include any of a variety of information, such as descriptions of people, places
15 or things, actors' biographies, music soundtrack information, director's notes, set
16 information, links (e.g., uniform resource locators (URLs)) to other sources of
17 information, and so forth.

18 By way of example, the popup information may include trivia related to the
19 actors in the AV content and the locations at which the AV content was filmed.
20 This trivia is then displayed to the user as AV content is played back. Which
21 trivia is to be displayed at which times, as well as the location of the trivia on the
22 display, is identified in the programmatic data.

23 By way of another example, the popup information may include
24 descriptions of clothing or furniture being displayed as part of the AV content.
25 The user is then able to automatically purchase particular clothing or furniture

1 being displayed by selecting (e.g., "clicking" on) the popup information. When
2 the user selects the popup information, programmatic data control module 108
3 uses the programmatic data to identify a link (e.g., a URL) and communicates with
4 the device identified by the link to purchase the particular clothing or furniture.
5 Additional information may also need to be input by the user in order to proceed
6 with such purchases (e.g., the desired size or color of an item, billing and/or
7 shipping addresses, credit card number, etc.), or alternatively such information
8 may already be available (e.g., previously stored in content player 102 by the user,
9 or at the server to which the popup information links).

10 The popup information can overlay on top of the AV content opaquely or
11 semi-transparently (e.g., alpha blended) using any of a variety of well-known
12 techniques.

13 Infopause

14
15 The Infopause functionality is similar to the Popup Information
16 functionality, but differs in that the popup information is displayed to the user only
17 when playback of the AV content is paused. Thus, using the Infopause
18 functionality, the user is not distracted by the popup information while the AV
19 content is playing, but is presented with the popup information whenever he or she
20 pauses the playback (assuming there is popup information to be displayed at the
21 point where the user pauses playback of the AV content). As in the Popup
22 Information functionality, any of a variety of information or text can be displayed
23 to the user, such as actors' biographies, music soundtrack information, director's
24 notes, set information, and so forth, and the information may be linked (e.g.,
25

1 allowing purchase of the music soundtrack, clothing or furniture being displayed
2 during the pause, etc.).

3 4 360 Degree Pause

5 When playback of the AV content is paused, the user can rotate the camera
6 around the scene from a fixed location within the scene at the point the AV
7 content is paused. This pausing may be, for example, the typical pausing of the
8 content playback achieved by pressing the "pause" button on a remote control.
9 This camera movement is as if the camera shooting the current scene of the AV
10 content (when paused) were to remain in its current location but could be rotated,
11 essentially allowing the user to pan to the left or right (and optionally up or down)
12 around the scene. This movement can be, for example, a full 360 degrees
13 (although alternatively less than 360 degrees of rotation could be provided if
14 desired). When playback of the AV content is paused, programmatic data control
15 module 108 uses the programmatic data to present the 360 degree scene.

16 The programmatic data representing the 360 degree scene data can be a
17 separate video track or stream received from the media source that can be played
18 back to present the full 3D scene, or alternatively the programmatic data may be
19 used by programmatic data control module 108 to generate the 360 degree scene
20 presentation. For example, the 360 degree views not included in the scene of the
21 AV content can be generated in accordance with the "Virtual Walkthrough" (e.g.,
22 using video textures as described in A. Schödl, R. Szeliski, D. H. Salesin, and I.
23 Essa, "Video Textures", *Computer Graphics (SIGGRAPH'2000) Proceedings*,
24 pages 489-498, New Orleans, July 2000), or QuickTime VR (available from Apple
25 Computer, Inc. of Cupertino, CA).

1 The user may be able to pause playback of the AV content at any point and
2 rotate the camera around the scene, or alternatively the user may be restricted to
3 rotating through the scene at only particular points of the AV content. For
4 example, the AV content and/or programmatic data developer may desire to
5 restrict the user to being able to rotate the camera around the scene at only certain
6 points of the AV content.

7 8 360 Degree Playback

9 The 360 Degree Playback functionality is similar to the 360 Degree Pause
10 functionality, but differs in that it allows a user to rotate the camera around the
11 scene 360 degrees during playback of the AV content. Thus, using the 360 Degree
12 Playback functionality, the user can rotate the camera around the scene at any
13 point during playback of the AV content, or alternatively only at particular points
14 of the AV content.

15 16 Intelligent Scanning

17 The programmatic data includes data that identifies important parts of the
18 AV content, such as scenes that are important for the plot of a movie or television
19 program. By including such a mark-up of important parts in the programmatic
20 data, a user can scan forward and backward through these important parts of the
21 AV content instead of skipping multiples of linear frames for fast forwarding or
22 rewinding. For example, the user can scan forward to the next important
23 interaction between two characters and content player 102 will start playing the
24 scene at the normal “play” rate. When the user is ready, he or she can then scan
25 forward to the next important plot point (e.g., by pressing a button).

Additionally, multiple sets of programmatic data for the Intelligent Scanning functionality may be associated with the same AV content. For example, there may be various sub-plots throughout a movie or television program and the programmatic data can identify the starting points for scenes important to each of these sub-plots, thereby allowing the user to easily scan through and play back the scenes for each sub-plot. By way of another example, there may be particular characters or actors that appear in various scenes throughout the movie or television program. The programmatic data can identify the starting points for scenes including particular characters and/or actors, thereby allowing the user to easily scan through and play back the scenes including each of the particular characters and/or actors.

Furthermore, the programmatic data may also include stopping points for each important part. In such embodiments, when the user invokes the Intelligent Scanning functionality, playback of the AV content could be fast forwarded to the next scene important for the plot of a movie or television program. After that scene has been played back (the stopping point for the scene having been identified in the programmatic data), the playback can automatically scan forward to the next scene important for the plot and playback of that scene can begin.

Free Camera

The Free Camera functionality is similar to the 360 Degree Playback functionality, but differs in that the Free Camera functionality allows the camera to be moved to different locations in the scene. Thus, rather than being limited to rotating the camera (e.g., panning left, right, up, down, etc.) from a fixed position, the camera position can be moved. In some embodiments the camera position can

1 be moved to any position within (or possibly even outside) the scene, while in
2 alternate embodiments the camera position can be moved to only particular
3 positions (e.g., positions that the AV content designer chooses to allow).

4 The programmatic data representing the Free Camera scene data can be a
5 separate track or stream received from the media source that can be played back to
6 present the scenes viewed using the Free Camera functionality, or alternatively the
7 programmatic data may be used by programmatic data control module 108 to
8 generate the scene presentation resulting from movement of the camera. For
9 example, when the camera position is moved, the new view of the scene from the
10 new position can be generated using Lumigraph data (e.g., as described in S. J.
11 Gortler, R. Grzeszczuk, R. Szeliski, and M. F. Cohen, "The Lumigraph",
12 *Computer Graphics Proceedings, Annual Conference Series*, pages 43-54, Proc.
13 SIGGRAPH'96 (New Orleans), August 1996). Given the new position of the
14 camera, the camera view can then be rotated (e.g., panning left, right, up, down,
15 etc.) from that position as discussed above with regard to the 360 Degree Playback
16 functionality.

17 18 Virtual Walkthrough on Rails

19 The programmatic data includes data that allows a pre-determined tour of a
20 scene or areas beyond a scene. Analogous to the Free Camera functionality, the
21 programmatic data representing the tour can be a separate track or stream received
22 from the media source that can be played back to present the tour, or alternatively
23 the programmatic data may be used by programmatic data control module 108 to
24 generate the tour. The tour can optionally include audio as well (e.g., sounds of
25 villagers going about their business, sounds of animals or weather, the voice of a

1 “tour guide” pointing out various features scene from the video of the tour, etc.).
2 The user can exit the tour by pressing, for example, a stop button or a play button
3 (e.g., the play button causing playback of the AV content to resume).

4 The Virtual Walkthrough on Rails functionality allows the user to, for
5 example, explore scenes or areas related to a current scene in additional detail.
6 For example, during playback of a movie a particular scene may occur in a
7 particular village. If the user desires to see more information about this particular
8 village, he or she could invoke the Virtual Walkthrough on Rails functionality to
9 take a tour of the particular village, then resume playback of the AV content.

10 11 Freeform Exploration of the World

12 The Freeform Exploration of the World functionality is similar to the
13 Virtual Walkthrough on Rails functionality, but differs in that the user is able to
14 move around in directions and to areas that he or she desires, rather than being
15 limited to the tour as in the Virtual Walkthrough on Rails functionality. The
16 Freeform Exploration of the World functionality allows, for example, the user to
17 explore scenes or areas as he or she desires, such as to explore a particular village
18 rather than being limited to a particular tour of that village.

19 20 Multiplayer Worlds

21 The Multiplayer Worlds functionality is similar to the Freeform
22 Exploration of the World functionality, allowing the user to explore scenes or
23 areas as he or she desires. Additionally, other users (e.g., using other content
24 players 102) are allowed to explore scenes or areas as they desire, and the various
25

1 users are able to see one another and interact with one another within the scenes or
2 areas.

3 The Multiplayer Worlds functionality may optionally involve the content
4 player(s) 102 communicating with one or more server devices. Such server
5 devices may control the world (e.g., scenes and areas) accessible to the various
6 users, maintain records of which users are in the world, and maintain records of
7 where the various users are located in the world so that the users can view one
8 another in the world. Such server devices may also coordinate or facilitate the
9 users communicating with one another.

10 Additionally, notifications may be provided to the user regarding actions
11 going on in the world that may correspond to events that are occurring (or have
12 occurred or are to occur in the future) in the story being told by the AV content
13 during playback.

14 Thus, it can be seen that the Multiplayer Worlds functionality allows the
15 AV content to operate as a launching pad for a massively multiplayer (MMP)
16 world or game that many users can interact with and explore concurrently.

17 18 Takeover Action

19 The programmatic data includes data that allows a user to play along with
20 the linear story of the AV content as a virtual actor. This may involve
21 compositing a virtual actor into the scene or action. The user's actions may have
22 significant impact on the storyline or characters, or the user can "let go" of the
23 controls and the linear story will progress as normal. By way of example, a horror
24 film might let a user "play" any of the characters at any time during the story, but
25 then allow the user to "let go" of control to see what happens next. The user's

1 actions and the results thereof may be composited onto the linear AV content or be
2 completely rendered on-the-fly from a different point of view not shown in the AV
3 content. Optionally, completely new storylines can be pursued by the user that
4 can be tangential to the story of the linear AV content. The new views resulting
5 from the user's actions can be generated in any of a variety of manners, analogous
6 to the Free Camera functionality discussed above.

7 The Takeover Action functionality may also result in different storylines
8 for the linear AV content. For example, if the linear AV content were to be
9 paused at a point where the hero is to jump onto a moving truck, the user may be
10 able to take over the action of the hero and try to make the jump himself or herself
11 (e.g., using the buttons on a remote control or game controller to control the hero's
12 actions). If, when the user is controlling the hero, the jump is not made, then an
13 alternate storyline may be followed for the AV content.

14 Compositing of Dynamic Rendered Data into Linear AV Scene

15
16 To take the Freeform Exploration of the World functionality and/or
17 Multiplayer Worlds functionality further, the users' actions may be integrated and
18 "composited" into the AV content. For example, if a user, while interacting in a
19 village during the Freeform Exploration of the World functionality, burns down a
20 house in a village, the next time the user plays the AV content of the movie, that
21 house appears destroyed when the characters in the AV content walk past it in the
22 movie.

23 This can be done, for example, by the programmatic data including data for
24 the house in the village having been destroyed. Programmatic data control module
25

1 can composite the rendered scene of the destroyed village with the AV content,
2 allowing this alternate village to be displayed.

4 Playalong with Linear Story

5 The programmatic data includes data that allows a user to take over control
6 of the action in the AV content in a limited way that does not change the linear
7 story of the AV content. This is similar to the Takeover Action functionality, but
8 specifically limits the user's control so that it does not change the linear story of
9 the AV content. For example, following the jumping example discussed above in
10 the Takeover Action functionality, if the hero were supposed to make the jump but
11 under the user's control the hero were to miss the jump, then a new linear AV
12 stream may be displayed that fuses the results into the main story of the AV
13 content. By way of example, rather than arriving at a particular destination as a
14 result of jumping onto the moving truck, the hero may arrive at that destination as
15 a result of hitching a ride with a passerby or stealing a motorcycle.

16 The user's actions as a result of controlling characters using the Playalong
17 with Linear Story functionality may optionally be composited into the linear AV
18 content as discussed above in the Compositing of Dynamic Rendered Data into
19 Linear AV Scene functionality.

21 Multiform Stories

22 The programmatic data can include data that allows a user to select a
23 different storyline or viewpoint of the same story dynamically as the base story is
24 told by playback of the AV content. For example, while watching a murder
25 mystery, the user may be able to select a different character in the middle of a

1 scene and watch the rest of the story unfold from their point of view – possibly
2 altering the original, unaltered “linear” story. The user is able to fast
3 forward/rewind in that new track, possibly finding different backstory or a
4 different final ending (or means to the same ending) as the base story. The new
5 views resulting from the user’s actions can be generated in any of a variety of
6 manners, analogous to the Free Camera functionality discussed above (e.g., as
7 tracks already available from the media source, or generated on-the-fly by content
8 player 102).

9 10 Character Innerdialog

11 The programmatic data can include data that allows a user to hear the inner
12 dialog or motivations of an onscreen character(s) that are not played as part of the
13 regular audio stream of the AV content. The inner dialog or motivations can be
14 played back, for example, through the speakers of a headset. The programmatic
15 data can include one or more additional audio tracks and/or audio streams that
16 include the audio for the inner dialog or motivations.

17 Additionally, the user may optionally be able to choose one or more
18 characters from multiple characters (typically onscreen characters, but may
19 include characters not being shown in the scene) and have only the inner dialog or
20 motivations for that character played back. The selection can be performed in a
21 variety of manners, such as by using a remote control or game controller to move
22 an on-display cursor and allow a “click” using a button or trigger while the on-
23 display cursor is on one of the characters result in selection of that character,
24 having buttons and/or triggers on a remote control or game controller assigned to
25 particular user-selectable characters, having another on-display selection interface

1 (such as a pull-down menu, text entry field, radio buttons or check boxes, etc.).
2 The user may optionally be allowed to select different characters in the same
3 manner as playback of the AV content continues.

4 Furthermore, in certain embodiments, the inner dialog or motivations for
5 multiple different characters may be presented to the user concurrently. The audio
6 for these different inner dialogs or motivations may be combined together, or
7 alternatively may be presented in different manners (e.g., the inner dialog or
8 motivations for one character played back in a left speaker of a headset, while the
9 inner dialog or motivations of for another character are played back in a right
10 speaker of the headset).

11 12 Character Interaction

13 The programmatic data can include data that allows a user to interact with
14 the onscreen characters of the linear AV content such that the user can influence
15 the character while the linear story of the AV content unfolds (possibly causing
16 the onscreen character to behave in a different manner). For example, a dating
17 television program or movie may allow the user to “chat” with the onscreen
18 character while the character is flirting with another onscreen character. The
19 user's dialog with the onscreen character can influence the character's
20 conversation, mood, final choice, and so forth. The user can interact with the
21 onscreen character(s) in a variety of manners, such as using a remote control or
22 game controller, a headset with a microphone, and so forth.

Displaying Simultaneous Action

The programmatic data can include data that allows a user to dynamically select different screens to appear concurrently giving different information about the linear story of the AV content simultaneously. Which screens are displayed at any particular time can be chosen by the user, and can change as the story of the AV content progresses. For example, popup contextual information that is overlaid on the video about the details of the scene or actor may be chosen by the user; or possible plot enhancing information (such as a camera from the point of view of the killer waiting in the woods can be brought up while watching the campers around the fire are telling ghost stories).

In order to display such multiple screens concurrently, the display is separated into two or more regions, each region being for a different screen that is to be displayed. These different regions may be of the same or different sizes, and the sizes may be user-selectable.

Automatic Recap or Summary

The programmatic data can include data that is a mark-up of plot or important information in the AV content. This mark-up can be, for example, a reference to important scenes of the AV content. A user is thus able to view a “recap” of the “plot points” of the AV content when starting from a point in the middle of the stream. The recap can also serve to give a digested version or summary of the entire AV Stream.

By way of example, if the user begins watching the AV content in the middle of the content, he or she can first be presented with the automatic recap or summary which presents the import scenes of the AV content that have occurred

1 up to the point the user is going to begin watching the AV content. This allows
2 the user to receive a summary of the important parts of the AV content that have
3 occurred up to the point at which the user is going to begin watching the AV
4 content.

5 In one implementation, the Automatic Recap or Summary functionality
6 allows the user to resume playback of the AV content at a later time, and be
7 presented with a recap of the AV content up to the point where he or she
8 previously stopped playback of the AV content. For example, the user may begin
9 watching the AV content on Monday, and then stop playback at some point (e.g.,
10 in approximately the middle of the movie or television program). This stopping
11 location can be remembered by content player 102 (e.g., stored on a memory
12 device of content player 102). If the user desires to resume playback on Tuesday
13 evening, he or she can have a summary or recap of the portions he or she has
14 already seen automatically presented to him or her, then have playback of the AV
15 content resume at the location at which he or she stopped playback on Monday.

16 17 Animated Pause

18 The programmatic data can include data that allows elements in a scene to
19 continue moving even though playback of the AV content has been paused. For
20 example, a user can pause on a scene and the actors will stop moving, but the
21 waterfall in the background can still move, birds chirp, music plays, and so forth.
22 The plot is “frozen” and not progressing, but some of the scene can still be
23 displayed or played as moving. The views displayed to and the sounds played to
24 the user with the Animated Pause functionality can be generated in any of a
25 variety of manners, analogous to the Free Camera functionality discussed above

1 (e.g., as tracks already available from the media source, or generated on-the-fly by
2 content player 102).

3 4 Different Levels of Maturity in Content

5 The programmatic data can include data that represents one or more
6 variations of portions of the AV content. This allows different versions or editions
7 of the AV content to be played back in different situations (e.g., for different
8 audiences). For example, a particular DVD can be R-Rated, but when played by a
9 child without access to the parental “lockout” code, the version they see would be
10 similar to the “made-for-TV” version: expletives either deleted or dubbed over
11 and mature scenes removed (or even altered). The programmatic data can include,
12 for example, different linear “alternative” streams for one or more of the different
13 versions that may be played back, or alternatively the different versions can be
14 generated on-the-fly analogous to the Free Camera functionality discussed above.

15 16 Episodic Download of Additional Content

17 The programmatic data can include data that allows the user to access
18 additional episodic content associated with the AV content. For example,
19 additional scenes, additional audio tracks or audio streams, the programmatic data
20 for other enhanced functionality described herein, and so forth may be available to
21 the user. The programmatic data can include, for example links (e.g., URLs) that
22 when selected direct content player 102 to a device (e.g., a remote device via the
23 Internet) from which the additional episodic content associated with the AV
24 content can be obtained. The source of such additional episodic content can thus
25 be an additional media source 104.

1 The episodic download of additional content allows, for example, expanded
2 scenes to be presented to the user, a director's cut version of the AV content to be
3 presented to the user, humorous outtakes to be presented to the user, and so forth.

4 Optionally, an additional fee may be charged for access to the additional
5 episodic content.

6 7 Head Mounted Display and 3D Spatialization data

8 The programmatic data can include data that is 3-Dimensional (3D)
9 spatialization data of the AV content. When the user is using a display device(s)
10 that can give stereoscopy (Head Mounted Displays, shutter glasses, etc), content
11 player 102 can render the appropriate programmatic data to allow the 3D
12 playback. The programmatic data can include the 3D spatialization data for one or
13 more scenes of the AV content.

14 15 Example Data Structure

16 The programmatic data and AV content can be maintained and transmitted
17 in accordance with any of a variety of formats. This section illustrates example
18 formats in which the programmatic data and AV content can be maintained and
19 transmitted. It is to be appreciated that these formats are only examples, and that
20 other formats can alternatively be used.

21 Table I illustrates an example format for AV content. In Table I, the AV
22 content is a data stream that includes audio and video data, as well as other data
23 related to the audio and video data.

Table I

Field	Description
Video	Includes the data for the video portion of the AV content. Typically, the data is compressed, such as using any of the versions of MPEG (Moving Pictures Experts Group), such as MPEG-1, MPEG-2, or MPEG-4, WMV (Windows Media Video), and so forth. May optionally include multiple tracks for multiple different camera views or angles.
Audio	Includes the data for the audio portion of the AV content. The audio can be in one of different types, such as Mono, Stereo, Surround, Dolby Digital 5.1, etc. May include multiple audio tracks in different languages, as well as a "commentary" audio track (e.g., Directors' commentary, actors' commentary, etc.). The data may be in uncompressed form or compressed form (e.g., compressed using WMA (Windows Media Audio), MP3 (MPEG Audio Layer-3), etc.).
Textual	Includes textual data corresponding to the AV content. For example, may include subtitles in one or more languages.
Positional Data	Includes various data regarding the AV content. For example, may include DVD track/chapter information, time codes, SMPTE (Society of Motion Picture and Television Engineers) code, byte position of an AV stream, etc.

Table II illustrates an example format for programmatic data. Various fields are described in Table II. It is to be appreciated that not all programmatic data need include values for all of the fields in Table II, or even include all of the fields in Table II. For example, if particular programmatic data does not support the Different Levels of Maturity in Content functionality, then the Different Levels of Content for Different Ratings field may be left blank and/or may not be included in the data structure. It should also be noted that the data in different fields of Table II can be used for multiple enhanced functionalities. For example, the 3D Representational Data in Table II can be used for the 360 Degree Pause functionality, the 360 Degree Playback functionality, the Freeform Exploration of the World functionality, and so forth.

Table II

Field	Description
3D Representational Data	Includes 3-dimensional representational data used to generate or synthesize a scene. Examples of types of data that may be included are geometry data, texture data, lightmap data, shadowmap data, models, and so forth.
360 Degree Pictorial Information	Includes the data for 360 degree views not included in the scene of the AV content. Can be in accordance with, for example, the "Virtual Walkthrough", or QuickTime VR (available from Apple Computer, Inc. of Cupertino, CA).
2D Information	Includes the data for rendering from another viewpoint not included in the scene. Can use, for example, Lumigraph data.
Markups	Includes the markup data identifying the plot and/or important parts of the AV content.
Executable	Includes the set of instructions (e.g., the programmatic data control module) discussed above.
Functionality for Different Devices	Includes data identifying what enhanced functionality is available from the programmatic data based on what devices are available (e.g., what devices are currently coupled to the content player). For example, different functionality may be available depending on whether a DVD remote control unit is available, a game controller is available, a headset is available, and so forth.
Enhanced Video/Audio	Includes the additional data to enhance the video and/or audio data of the AV content. May include additional audio channels or tracks.
Informational Data	Includes informational data regarding the AV content. For example, may include: biographies and filmographies of actors; links to other movies, directors, actors, etc.; data to be displayed in pop-ups; URLs or other links to information that the user can navigate; and so forth.
Different Levels of Content for Different Ratings	Includes data identifying which content is to be displayed for which rating. May be in reference to: MPAA (Motion Picture Association of America) or MPA (Motion Picture Association), such as NC-17, R, PG-13, PG, G ratings; ESRB (Entertainment Software Rating Board), such as T-Teen, M-Mature, E-Everyone, etc.; user-defined ratings, such as Primetime TV, Late-night TV, subscription TV, Made-for-TV, etc.
Different Display Formats	Includes the data for displaying video in different display formats. For example, may include data for: NTSC

(National Television Standards Committee) format or PAL (Phase Alternating Line) format; widescreen format or letterbox format or HDTV (High Definition TV) format; Pan and Scan format; and so forth.

Example Device

Fig. 6 illustrates an exemplary general device 300. Device 300 can be, for example, a content player 102 of Fig. 1. Device 300 includes at least one processing unit 302 and memory 304. Depending on the exact configuration and type of device, memory 304 may be volatile (such as RAM), non-volatile (such as ROM, flash memory, etc.) or some combination of the two. Device 300 also includes additional storage, such as magnetic or optical disks or tape, in the form of removable storage component 308 and/or non-removable storage component 310. Removable storage component 308 can read from (and optionally write to) removable storage devices, such as magnetic or optical disks or tape. In certain embodiments, removable storage component 308 can read from (and optionally write to) a DVD 318. Device 300 may also include one or more additional processing units, such as a co-processor, a security processor (e.g., to perform security operations, such as encryption and/or decryption operations), and so forth.

Device 300 also includes one or more input devices 314, such as a keyboard, a mouse, a pen, a voice input device (such as a microphone), a touch input device, a game controller, an IR or RF receiver to receive commands from a remote control, and so forth. Device 300 may also include one or more output devices 316, such as a display, one or more speakers, and so forth.

Various modules and techniques may be described herein in the general context of computer-executable instructions, such as program modules, executed

1 by one or more computers or other devices. Generally, program modules include
2 routines, programs, objects, components, data structures, etc. that perform
3 particular tasks or implement particular abstract data types. Typically, the
4 functionality of the program modules may be combined or distributed as desired in
5 various embodiments.

6 An implementation of these modules and techniques may be stored on or
7 transmitted across some form of computer readable media. Computer readable
8 media can be any available media that can be accessed by a computer. By way of
9 example, and not limitation, computer readable media may comprise "computer
10 storage media" and "communications media."

11 "Computer storage media" includes volatile and non-volatile, removable
12 and non-removable media implemented in any method or technology for storage
13 of information such as computer readable instructions, data structures, program
14 modules, or other data. Computer storage media includes, but is not limited to,
15 RAM, ROM, EEPROM, flash memory or other memory technology, CD-ROM,
16 digital versatile disks (DVD) or other optical storage, magnetic cassettes, magnetic
17 tape, magnetic disk storage or other magnetic storage devices, or any other
18 medium which can be used to store the desired information and which can be
19 accessed by a computer.

20 "Communication media" typically embodies computer readable
21 instructions, data structures, program modules, or other data in a modulated data
22 signal, such as carrier wave or other transport mechanism. Communication media
23 also includes any information delivery media. The term "modulated data signal"
24 means a signal that has one or more of its characteristics set or changed in such a
25 manner as to encode information in the signal. By way of example, and not

1 limitation, communication media includes wired media such as a wired network or
2 direct-wired connection, and wireless media such as acoustic, RF, infrared, and
3 other wireless media. Combinations of any of the above are also included within
4 the scope of computer readable media.

5 6 **Conclusion**

7 Although the description above uses language that is specific to structural
8 features and/or methodological acts, it is to be understood that the invention
9 defined in the appended claims is not limited to the specific features or acts
10 described. Rather, the specific features and acts are disclosed as exemplary forms
11 of implementing the invention.